

THE DIS-APPEARANCE OF TECHNOLOGY AND RE-APPEARANCE OF NATURE
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In the realm of contemporary responsive environments, technology is often an evident feature for the user that is involved in the spatial, sensorial, or interactive experience. Although essential for enabling its realization, technology is however perceived as a non-natural phenomenon, almost at the opposite extreme of what we generally refer to Nature. But what if technology, instead, hides itself for enhancing and making manifest certain characteristics of the natural world? This series of case studies demonstrates how technology can be used to promote, simulate, or recreate responsive natural phenomena that engage the user in such a way that the adopted techniques are almost not perceived anymore – or, better, the user is fully immersed in the interactive experience without question the role that technology plays as enabler. This disappearance of technology then allows for the reappearance of Nature, detaching the user from questioning technological aspects in favor of an engaging relationship with natural – or hyper-natural – phenomena.

The first example of how technology can be used to activate and simulate natural phenomena, or give the sensation of natural behaviors, is the Cloudscapes project, developed by and Transsolar and Tetsuo Kondo Architects for the 12th International Architecture Biennale in Venice. This project investigates the poetic nature of clouds, recreating a natural phenomenon that involved the visitors in an immersive experience. In particular, by controlling the microclimate of the space in the Arsenale building, a layer of

artificial clouds were made to hover above the ground level, remaining in balance above the heads of the viewers. To fully experience the immaterial lightness of clouds, a winding system of ramps was situated in the middle of the room, allowing the viewers to feel and touch the clouds by physically entering it, walking over it, and back down again. By walking on this pathways visitors could gradually experience the three layers of distinct climates in the room, enjoying a unique atmosphere with different qualities of light.

A closer – though more artificial – relationship with nature was possible to experience by visiting the Hylozoic Ground installation, again at the 12th International Architecture Biennale. The project's title refers to 'hylozoism', the ancient belief that all matter has life. Relating to the new paradigm of ProtecCell Architecture, Hylozoic Ground offers a vision for a new generation of responsive architecture. Specifically, embedded machine intelligence allows human interaction to trigger breathing, caressing, and swallowing motions and hybrid metabolic exchanges. The so created environment is similar to a coral reef, following cycles of opening, clamping, filtering and digesting. Arrays of touch sensors create waves of diffuse breathing motion, luring visitors into the shimmering depths of a forest of light.

The same objective of recreating natural environment is what drove ecoLogicStudio to design a both physical and digital garden for an exhibition at the Architectural Association in London. In particular, H.O.R.T.U.S. (Hydro Organism Responsive to Urban

Stimuli) engages the notions of urban renewable energy and agriculture through a new gardening prototype. The project can be described as a proto-garden that hosted micro and macro-algal organisms as well as bioluminescent bacteria. Users could daily engage with H.O.R.T.U.S by blowing air inside the various containers (photo-bioreactors) as well as adjust their nutrients' content; oxygen is released as a result, feeding the other organisms in the "briccole"(bioluminescent bacteria) and in the room. Visitors could also contribute to the emergence of a virtual garden, accessible via smart phones; its virtual plots were nurtured by the flow of observations posted by each visitor, locally and globally, by lighting levels data streams, and by human interaction in real-time.

When dealing with the inherent properties of materials, technology really seems to disappear. That is the case of Warped, a project developed by Matthew Hume in 2008. The project's idea lies in the way that the material becomes both the sensing and actuating agent. Warped is in fact a set of walls, columns, and arches composed from mechanically joined plywood elements that respond to changes in atmospheric moisture by twisting and bending between open and closed conditions. In particular, the wood grain senses the moisture by expanding, which the plywood cells convert into productive motion. Warped discovers new uses for the ply process by introducing space and shape between the subsequent layers of veneer. In this way, the material can reshape itself in direct response to environmental moisture, letting the entire

structure twisting to various degrees between dry and wet conditions.

As the previous example demonstrates, nature-like dynamics are always very evocative and let the user focus on the perceptual experience rather than on what is the origin of the kinematics. Although the adopted technology is much more evident and is not related to material properties, in the following example the effect and the sensation that is created is again very "natural." Specifically, Interactive Curtain is a project that aims to generate organic dynamics that respond to its users. The system is basically composed by portals that open up when a person is approaching. The interactivity is achieved through ultrasonic distance sensors that are able to identify the location of users coming within a range of interaction with the portal. The result is a kinematic experience that reminds that reminds of certain organic behaviors.

A more fluid and less mechanized natural dynamics are achieved in the Reef project, by Rob Ley. Reef investigates the role that emerging material technology can play in the sensitive reprogramming of architectural and public space. A field of sunflowers as they track the sun across the sky or a reef covered with sea anemones, offer an image of the type of motion this project was inspired by. The installation makes use of Shape Memory Alloys (SMAs), a category of metals that change shape according to temperature. Shifting from biomimetic to biokinetic, the 'reef' changes and interacts with the proportions of the storefront's façade, progressing from a single surface

to an enclosed vault that creates multiple layers of interactivity.

The same fascinating interpretation of nature is achieved in Shoal, a project developed by Troika in the Corus building in Toronto. Shoal is a multimedia installation, inspired by natural phenomena, that has been created in response to nature/humans conflicts that characterize Toronto's waterfront. The objective was in fact to make a reintegration of nature through 467 fish-like objects, wrapped in iridescent dichroic acrylic foil and suspended from the ceiling, that rotate rhythmically around their own axis, displaying the movements and interdependency typical of shoals of fish. With no added lighting, the fishes take on a different color from different angles, creating an incredibly effective dynamic experience.

Exploring new relationships between natural formations and technology design, Elaine Ng Yan Ling developed the concept of Techno-Naturology. In particular, the term refers to the use of artificial technology to activate and simulate natural reactions. Playing with different materials, this project explores the functional and symbiotic relationship between shape memory alloy/polymers and the natural sensing system of wood. The intrinsic qualities of natural and artificial materials are investigated using the hybrid tectonic system to challenge preconceived limitations and increase the potential of textiles. The resulting effect of tectonic motion is not only about mimicing the behaviour of nature, but also a means of evoking natural movements for potential applications in architecture.

A thoughtful research in finding meaningful relationships between material properties and human interaction for achieving natural dynamics is the one carried out by the Micro Synergetics cluster at SmartGeometry 2012 in Troy. The cluster's goal was to produce a modular, digitally augmented physical system interacting bi-directionally with the microenvironments around it. The developed prototypes both sensed the users and involved them in playful engagement, which sharpens their perceptions of otherwise unnoticed micro processes and -climates. Interesting materials such as conductive and thermochromatic paint were used to create kinematic prototypes that efficiently interact with the users.

Finally, an ironic attempt to bring life where it notoriously doesn't exist is the Scott Garner's Still Life project: an interactive gallery work that responds to real-world activity. Set in a wooden frame, the fruits and vases of the seemingly ordinary still life painting begin to tumble when a user rotates the work. In particular, Garner creates the world 'inside' the painting using videogame technologies and spatial sensors for the 3D scene to respond to the user's rotation of the frame.

In conclusion, this series of case studies demonstrate how meaningful interactive experiences can be created when natural behaviors, properties, or performances are taken as an inspiration for novel immersive environments. Evocative dynamics and emotional "closeness" are what usually characterize our ideal relationship with the natural world, and in-

novative technology can play a crucial role in fostering these sensations. Furthermore, if technology can be hidden or placed at a “background” level, then unexpected re-interpretations re-experiences of Nature can appear, enhancing a certain proximity with natural phenomenon that high-tech instruments notoriously tend to evade.

CLOUDSCAPES

Transsolar + Tetsuo Kondo architects, Venice Architecture Biennale 2010

This project investigates the poetic nature of clouds through an installation at the 12th International Architecture Biennale in Venice. By controlling the microclimate of the space in the Arsenale building, a layer of artificial clouds are made to hover above the ground level, remaining in balance above the heads of the viewers.

To fully experience the immaterial lightness of clouds, a winding system of ramps is situated in the middle of the room, allowing the viewers to feel and touch the clouds by physically entering it, walking over it, and back down again.

This meandering pathway aims to show all three layers of distinct climates in the room: on the ground level, the air is cool and dry; half way up the ramps among the clouds, the air is warm and humid; finally, one comes up above the cloud layer, the air is hot but moistureless.

By replacing pressure differences and temperature gradients, all instances of the structure offers a unique atmosphere with different qualities of light.



<http://www.designboom.com/weblog/cat/9/view/11396/transsolar-tetsuo-kondo-architects-cloudscapes-at-venice-biennale.html>



<http://www.youtube.com/watch?v=5JqaFAzR7Wo>

HYLOZOIC GROUND

Philip Beesley, Venice Architecture Biennale 2010

For the 12th International Architecture Biennale, Hylozoic Ground transformed the Canada Pavilion with an immersive, interactive environment made of tens of thousands of lightweight digitally-fabricated components fitted with meshed microprocessors and sensors.

The project's title refers to 'hylozoism', the ancient belief that all matter has life. Relating to the new paradigm of Protecell Architecture, Hylozoic Ground offers a vision for a new generation of responsive architecture. Specifically, the Hylozoic Ground environment can be described as a suspended geotextile that gradually accumulates hybrid soil from ingredients drawn from its surroundings.

Akin to the functions of a living system, embedded machine intelligence allows human interaction to trigger breathing, caressing, and swallowing motions and hybrid metabolic exchanges. These empathic motions ripple out from hives of kinetic valves and pores in peristaltic waves, creating a diffuse pumping that pulls air, moisture and stray organic matter through the filtering Hylozoic membranes. 'Living' chemical exchanges are conceived as the first stages of self-renewing functions that might take root within this architecture.

The so created environment is similar to a coral reef, following cycles of opening, clamping, filtering and digesting. Arrays of touch sensors create waves of diffuse breathing motion, luring visitors into the shimmering depths of a forest of light.



<http://www.hylozoicground.com/>



http://www.youtube.com/watch?v=v86B9Nz_LVU&feature=relmfu

H.O.R.T.U.S. (HYDRO ORGANISM RESPONSIVE TO URBAN STIMULI) ecoLogicStudio, AA London 2011

H.O.R.T.U.S., an exhibition from ecoLogicStudio designed for the AA Front Members Room, engages the notions of urban renewable energy and agriculture through a new gardening prototype. Fitted with ambient light sensing technologies and a custom designed virtual interface, H.O.R.T.U.S stimulates the emergence of novel material practices and related spatial narratives. The project can be described as a proto-garden that hosts micro and macro-algal organisms as well as bioluminescent bacteria.

Users engage daily with H.O.R.T.U.S inventing new protocols of urban bio-gardening; the biologic diversity within H.O.R.T.U.S is provided by lakes and ponds within Central London; as algal organisms require CO₂ to grow, visitors were invited to contribute by blowing air inside the various containers [photo-bioreactors] as well as adjust their nutrients' content; oxygen is released as a result, feeding the other organisms in the "briccole" (bioluminescent bacteria) and in the room.

Information flowing daily through H.O.R.T.U.S feeds its emergent virtual garden, accessible via smart phones; its virtual plots are nurtured by the flow of observations posted by each visitor, locally and globally, by lighting levels data streams and by human interaction in real-time. Such virtual organism offers the opportunity for capturing and sedimenting information and cultivation practices, enriching the material experience of the visitor turned urban "cyber-gardener".



<http://hortus.aaschool.ac.uk/>



WARPED

Matthew Hume, New York 2008

The project's idea lies in the way that the material becomes both the sensing and actuating agent. Warped is in fact a set of walls, columns, and arches composed from mechanically joined plywood elements that respond to changes in atmospheric moisture by twisting and bending between open and closed conditions. In particular, the wood grain senses the moisture by expanding, which the plywood cells convert into productive motion.

Warped discovers new uses for the ply process by introducing space and shape between the subsequent layers of veneer. It uses the directionality of the wood grain and its reshaping during shrinking and swelling to re-negotiate the means by which different layers can be controlled. In this way, the material can reshape itself in direct response to environmental moisture, letting the entire structure twisting to various degrees between dry and wet conditions.



INTERACTIVE CURTAIN

Hyperbody, TU Delft 2008

Similar principle of dynamic façade. Although technology is much more evident and is not related to material properties, the effect and the sensation that this project creates is very natural.

This project is composed by portals that open up when a person is approaching. In particular, the structure is made of PVC tubes which are supported by movable fiberglass panels – actuated by the system.

The interactive part of the system relies on ultrasonic distance sensors that are able identify the location of users coming within a range of interaction with the Portal. The programming of the Portal allows for six independent openings to be created at one time, allowing six people to traverse the portal simultaneously.



<http://www.protospace.bk.tudelft.nl/nl/over-faculteit/afdelingen/hyperbody/research/applied-research-projects/interactive-curtain/>

REEF

Rob Ley, New York 2009

A more fluid and less mechanized dynamics are achieved in this other project.

Reef investigates the role emerging material technology can play in the sensitive reprogramming of architectural and public space. A field of sunflowers as they track the sun across the sky or a reef covered with sea anemones, offer image of the type of motion this technology affords.

The project makes use of Shape Memory Alloys (SMAs), a category of metals that change shape according to temperature. Operating at a molecular level, this motion is similar to that of plants and lower level organisms that are considered responsive but not conscious.

Reef's unique exploration of technology shifts from the biomimetic to the biokinetic while liberating and extending architecture's capacity to produce a sense of willfulness. In addition, the 'reef' changes and interacts with the proportions of the storefront's façade, progressing from a single surface to an enclosed vault that creates multiple layers of interactivity.



<http://www.urbanaarch.com/Reef>



<http://www.youtube.com/watch?v=pbxTafJ13lc>

SHOAL

Troika, Toronto 2010

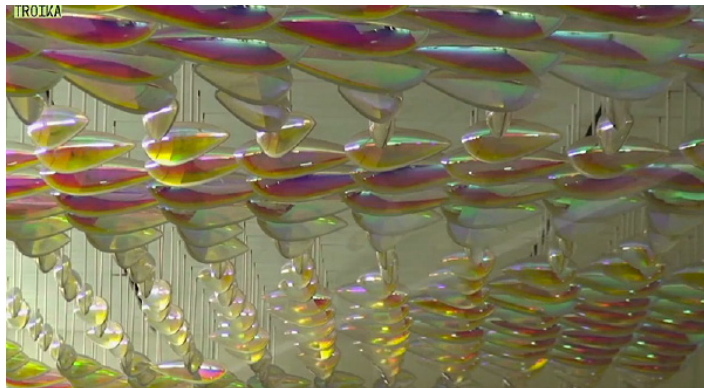
“We aim not to replace nature but to interpret it”, says the design collective Troika’s Eva Rucki.

Shoal, a new multimedia installation inspired by natural phenomena, has been created for the Corus building on Toronto’s waterfront at Queens Quay East. This particular coastline is a battleground between the man-made environment and nature

The objective was to make a reintegration of nature along the 50 meter long passage in the building which leads to the lake. Spanning this corridor, 467 fish-like objects wrapped in iridescent dichroic acrylic foil and suspended from the ceiling rotate rhythmically around their own axis, displaying the movements and interdependency typical of shoals of fish. With no added lighting, the fish take on a different color from different angles, driven by stepper motors.



<http://troika.uk.com/shoal>



<http://vimeo.com/15774656>

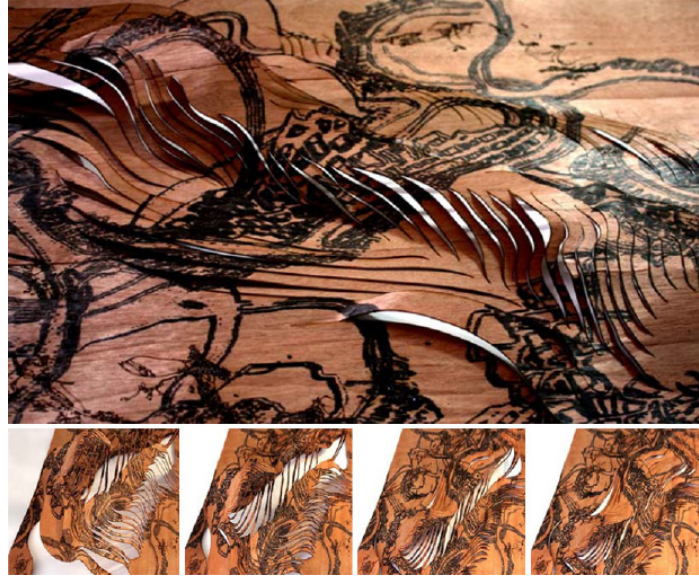
TECHNO-NATUROLOGY

Elaine Ng Yan Ling

Techno-Naturology is a concept developed by Elaine Ng Yan Ling to explore new relationships between natural formations and technology design. In particular, the term refers to the use of artificial technology to activate and simulate natural reactions.

The concept of 'Naturology' tectonic motion is not only about mimicing the behaviour of nature, but also a means of evoking natural movement within an urban landscape. With this design philosophy, the designer aims to enhance the fluidity and functional responsiveness of architecture, creating harmony within the urban environment.

Playing with different materials, this project explores the functional and symbiotic relationship between shape memory alloy/polymers and the natural sensing system of wood. The intrinsic qualities of natural and artificial materials are investigated using the hybrid tectonic system to challenge preconceived limitations and increase the potential of textiles.



<http://www.designboom.com/weblog/cat/8/view/12362/elaine-ng-techno-naturology.html>



<http://vimeo.com/14522270>

MICRO SYNERGETICS

Sascha Bohnenberger, SmartGeometry Troy 2012

The goal of this workshop cluster was to produce a modular, digitally augmented physical system interacting bi-directionally with the microenvironments around it. The developed modules both sensed the users and involved them in playful engagement, which sharpens their perceptions of otherwise, unnoticed micro processes and -climates.

Interesting materials such as conductive and thermochromatic paint were used. Conductive paint not only acts as a powerful connector material that allowed to paint circuits on any surface, but also behaved as a proximity sensor due to its magnetic capabilities.

In addition, thermochromatic paint and conductive paint overlaid each other so that a visual response of changes happening between the single layers was given to the user.



STILL LIFE

Scott garner, 2012

The project's goal was to bring life to a still life painting, through an interactive gallery work that responds to real-world activity.

Set in a wooden frame, the fruits and vases of the seemingly ordinary still life painting begin to tumble when a user rotates the work. In particular, garner creates the world 'inside' the painting using the game developing program Unity 3D. The scene consist of a camera and all desired lights and objects which are projected via a flat-screen television screen (the frame and 'canvas') fixed on a rotating mount. Attached to its back is a spatial sensor to detect tilt, and a driving program written in C communicates with the sensor and interacts with the unity 3D scene to respond to users' rotation of the frame.



http://scott.38.net/work/interactive/still_life/



<http://vimeo.com/35109750>